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NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

AN ASSESSMENT OF THE RELATIONSHIP BETWEEN
APTITUDE TEST SCORES AND REPRESENTATION OF
BLACKS AND HISPANICS IN U.S. NAVY OCCUPATIONS

by

Jon T. Barnhill

December, 1991

Thesis Advisor:

Mark J. Eitelberg

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An Assessment of the Relationship Between
Aptitude Test Scores and Representation of Blacks
and Hispanics in U.S. Navy Occupations

by

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Lieutenant, United States Navy

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ABSTRACT

This thesis examines the influence of aptitude test scores on black and Hispanic representation in Navy enlisted occupations (or ratings) from 1982 through 1990. A procedure to control for the influence of aptitude test scores is introduced and explained along with a system for categorizing enlisted ratings by their relationship to the Navy's stated mission. Graphical depictions of black and Hispanic representation in Navy occupations are then shown by aptitude group and occupational category. This is followed by a brief examination of minority participation in the Navy's petty officer paygrades from 1982 through 1990. The results of the study reveal that the disproportionate representation of minorities in Navy ratings persists even when aptitude is controlled, suggesting the importance of factors unrelated to aptitude in determining representation. The thesis concludes with a discussion of the strengths and weaknesses of the methodology used to measure the influence of aptitude scores on minority representation in Navy ratings.

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INTRODUCTION AND BACKGROUND

A. PURPOSE

This study attempts to estimate the influence of aptitude test scores on the occupational placement of blacks and Hispanics in the U.S. Navy enlisted force. The study analyzes the distribution of black, white, and Hispanic enlisted men among the Navy occupational specialties (or ratings) for the years 1986 and 1990 and compares the results to findings from 1982, for which the data have been previously analyzed.¹

In addition, this study examines the distribution of these minority groups by enlisted paygrade within each occupational area, particularly those in which the group appears to be most disproportionately represented.

B. INTRODUCTION

One of the primary goals of the Navy Affirmative Action Plan, or NAAP, is to "attain a minority enlisted population that as a minimum reflects the percentage of minorities in the general population." [REF. 1] The Navy achieved this goal for

¹ The terms "Hispanic" and "black" are used to provide consistency with past military Equal Opportunity research. More contemporary terms are "Latino" and "African-American." For simplicity, the terms "white" and "black" are used throughout to refer to non-Hispanic whites and non-Hispanic blacks. It is recognized that Hispanics may be members of any racial group.

blacks in 1983 and has exceeded it every year since. For Hispanics, as of fiscal 1990, Navy recruiting efforts have not kept up with the rapid rise of this segment of the U.S. population. Hispanics currently account for approximately 6 percent of the Navy and 8 percent of the U.S. population.²

Of more relevance to this research is an additional goal of NAAP, closely related to the above, which mandates that, "within legal constraints (i.e., proper qualification), minorities participate equitably in all occupational areas." [REF. 1] The extent to which this particular goal is achieved, the relevant factors impeding or promoting attainment of the goal, and the possible implications for the Navy form the primary focus of the study.

It has been well documented that minorities are not proportionately represented across the military's occupational specialties, including ratings in the Navy [REF. 2]. For example, in the fiscal 1989 Navy Equal Opportunity Assessment, an attempt was made to evaluate minority representation in Navy occupational specialties using Department of Defense (DOD) occupational groupings [REF. 2]. A listing of ten of the DOD occupational groups, with their Navy rating equivalents, are presented below in Table 1. While numerous DOD group codes were listed in the Equal Opportunity report,

² This comparison of Hispanic representation in the Navy with that in the general population is somewhat misleading because the Hispanic population is considerably younger than the white population (U.S. Bureau of the Census, 1991).

the point can be made by listing only the most overrepresented and most underrepresented ratings.

TABLE 1

Minority Representation in Selected Navy Enlisted Ratings:
The Five Most Overrepresented Ratings and the Five
Most Underrepresented Ratings

Five Most Overrepresented Ratings

Navy Rating	Percent Minority Representation *	Percent Over- represented
Ship Serviceman	60	115
Disbursing Clerk	52	84
Mess Specialist	50	79
Dental Technician	47	67
Radioman	41	46

Five Most Underrepresented Ratings

Navy Rating	Percent Minority Representation *	Percent Under- represented
Aviation Technician	12	-58
Electronics Technician	12	-58
Fire Control Technician	11	-60
Musician	10	-64
Sonar Technician	8	-71

* "Minority" is defined here as any non-white. Total minority representation of the Navy's enlisted force in fiscal 1989 was 28.1 percent.

Source: CNO Study Group's Report on Equal Opportunity in the Navy (1989).

Even though minority representation in Table 1 is not broken out into individual racial/ethnic groups, and the conversion inaccuracy notwithstanding, one can readily conclude that a fair measure of disparity exists within these occupations. Interestingly, the fiscal 1990 version of the same report went the extra step to delineate minorities by separate racial/ethnic groups (such as Asian-American, Pacific Islander, and Hispanic) for both men and women. These were specified in numerical and percentage format. However, because of what appears to be a printing error, not all DOD groups were listed in the table of minority percentages. Of the DOD groups listed in Table 1 that were included, there showed so little change, positive or negative, as to be negligible [REF. 3].

In 1988, the Chief of Naval Operations (CNO) commissioned a special Study Group on Equal Opportunity in the Navy. The study group's first report to the CNO stated that one goal of the Navy's Affirmative Action Plan should be to ensure an equitable distribution of minority enlisted personnel among all ratings and occupational fields in order to optimize minority upward mobility. The fiscal 1990 Equal Opportunity Assessment Report showed that minority representation remains unevenly distributed across the Navy rating structure and that minorities are underrepresented in the more technical ratings [REF. 3].

Although there are no specific minority goals for individual Navy ratings, "equitable representation" is based on the proportion of minorities (by individual ethnic group) within the Navy's enlisted force at the end of a particular fiscal year [REF. 4]. For example, at the end of fiscal 1990 blacks and Hispanics accounted for 17.6 percent and 6.1 percent, respectively, of all persons in the Navy's enlisted ranks. The assumption here is that blacks and Hispanics should also represent approximately these percentages of people assigned to separate Navy ratings throughout the enlisted force. However, this assumption, or expectation, appears to give little or no weight to factors such as qualifications for entrance, personal preference, or even gender restrictions. These important considerations are addressed in a later chapter.

A comprehensive examination of the effectiveness of the Navy's Affirmative Action Plan with regard to occupational placement and advancement of blacks and Hispanics was conducted by Gary J. Zucca, a former Navy officer, while at the University of Florida in 1984. A sizable portion of his work was devoted to an assessment of minority representation in occupational specialties. An attempt is made to replicate Zucca's study in this thesis and to show what, if any, changes may have occurred in minority representation over the past eight years since he performed his analysis.

Zucca found that, after controlling for education and aptitude, blacks and Hispanics were overrepresented in non-technical occupations and underrepresented in the more technical fields [REF. 5]. (Zucca uses the term "support technology." This is discussed below.)

This came as no surprise to informed observers. However, Zucca also found that black and Hispanic overrepresentation actually increased in non-technical ratings in direct relation to the degree of qualification required for entrance into those ratings. This refutes the notion that disproportionate minority representation can be attributed solely to lower aptitude levels. He asserts, then, that a significant number of highly qualified minorities are being "tracked" by Navy career counselors into support, rather than technical, ratings [REF. 5].

Zucca's study supports the view that "racial inequalities in representation with regard to occupational placement . . . are not explainable by the differences in human capital of Navy recruits" [REF. 5]. Such a finding justifies the existence of the Navy Equal Opportunity Program and, more specifically, the Navy Affirmative Action Plan. This thesis attempts to replicate the study by Zucca and compare his results with the latest data now available. The primary research objectives are: (1) Assess the accuracy and validity of Zucca's methodology for controlling for aptitude in the Navy's occupational placement process; and (2) Assuming

Zucca's procedure to be valid, and using his 1982 results as a basis of comparison, apply his methodology to the most current data and assess the present occupational distribution of blacks and Hispanics in the Navy.

C. BACKGROUND

Present issues can be placed in perspective by looking first at the history of minorities in the Navy. The presence of blacks in the Navy dates back to the colonial era and the days of sail. At the time, the ideal sailor was experienced, agile, quick to obey, willing to endure danger and discomfort, and sober. Any able-bodied man who came close to fulfilling this ideal was welcome in the Navy. Race was a secondary issue. [REF. 6]

Following the Civil War, attitudes toward blacks in the Navy rapidly changed. The policy of the Navy changed for a combination of reasons, but it basically followed the prevailing "Jim Crow" attitudes and legislation of the period. With the passage of time, the status of blacks on ships came to reflect the diminished condition of their civilian brothers ashore. Racism was becoming so deeply ingrained in American life that whites would rarely work with blacks.

1. The Steam Age

In the steam age the Navy was looking for a new type of enlisted man, possessing skills and talents very much unlike those demanded of wooden-ship sailors. Further, the

growing fleet, consisting of larger and more numerous ships, required more volunteers than previously. The new Navy thus depended upon young, white volunteers whose attitudes generally reflected the racist mentality that was taking hold throughout the nation. Rather than risk alienating potential white recruits, the Navy accepted few, if any, blacks, and segregated those in the service from their white shipmates.

[REF. 6]

The presence of blacks on ships became a source of discontent among white crew members and often resulted in violence. Since assignment within the ship determined messing and berthing arrangements, naval authorities succumbed to the practice of concentrating blacks in certain specialties that kept them isolated from the rest of the crew. Since it was believed by some at the time that blacks could not be trained in the complexities of steam engineering and electricity, they were relegated to the specialties of cook, messman, and steward. Additionally, believing that whites would take orders only from a member of their own race, the Navy withheld promotions from blacks so that progressively fewer attained the status of petty officer.

The manpower demands of World War I did little to affect the racial composition of the Navy. Of some 238,000 enlisted men on active duty in 1919 (a few months after the fighting ended but before demobilization began), roughly 6,000 were black, less than three percent of the total [REF. 6].

From 1919 to 1933 the Navy adopted a policy of refusing to accept new recruits who were black. In this post-war demobilization period, all vacancies, except among stewards and messmen, were filled by whites. Consequently, by the end of 1941 the Navy had just twenty-nine black sailors who were not messmen [REF. 6].

Like the Army, the Navy entered World War II as a racially segregated service, but blacks and whites were kept separate in a different fashion. The Army tried to maintain a specific number of units manned entirely by blacks (but commanded by whites), that were housed and employed in a manner that would minimize their contact with white soldiers. In contrast, the Navy enforced segregation by occupation. Black sailors, therefore, might serve with whites in a large warship, but with rare exceptions all of the blacks prepared and served food or waited upon the ship's officers. Because they performed the same duties, blacks could easily be segregated, eating and sleeping together separate from the rest of the crew. [REF. 6]

Again, like the Army, the Navy eventually modified its racial policy to meet the demands of war and, to a lesser degree, public sentiment. But official directives did not alter reality. The Navy still enlisted relatively few blacks, assigned the largest concentration of blacks to ladling out food, and provided just a minimal degree of integration into ships' crews. [REF. 6]

2. Post-World War II

In 1948 President Truman enacted Executive Order 9981. This order decreed equality of treatment and opportunity for all persons in the armed services without regard to race, color, religion, or national origin. The directive was greeted with scant enthusiasm by the services, but it nonetheless represented an important milestone in race relations. [REF. 6]

The Navy's expansion for the Korean War attracted more black recruits than could be absorbed in the steward's branch, thus forcing the service to broaden opportunities for training in other specialties. In 1956, with the last of the wartime, three-year enlistments expiring, three-fourths of the 37,000 blacks in a 591,000-man force received assignments to the general service [REF. 6].

In the 1960s, under Secretary of Defense McNamara, the Navy continued to broaden opportunities for blacks, which subsequently benefitted all minorities. Prejudicial attitudes of some whites persisted, however, and a period of racial tension marked by episodes of violence ensued. Like their civilian counterparts, blacks in the Navy were now demanding equal and fair treatment.

By 1970, when Admiral Zumwalt was the Chief of Naval Operations, the proportion of black officers in the Navy stood at just 0.7 percent. At the same time, blacks represented just 5.5 percent of the Navy's enlisted force, about half the

proportion of blacks in the general population [REF. 6]. Zumwalt attempted to encourage the recruitment of more blacks into the Navy by relaxing enlistment standards. However, recruiting stations still relied heavily on aptitude tests to make occupational assignments for enlisted men. Zumwalt's decision to lower standards to attract additional black recruits proved self-defeating, for no systematic effort was made to help them overcome their educational shortcomings. As a result, a majority of blacks could not score well enough on aptitude tests to qualify for many of the more desirable ratings. Consequently, low skill and menial labor occupations became or remained overrepresented by blacks.

As American participation in the Vietnam fighting diminished, draft calls declined, and pressures to enlist in the Navy to avoid the Army infantry rapidly eased. The declining pool of draft-induced volunteers forced Zumwalt, in his effort to broaden the racial composition of the service, to accept blacks with poor records of past achievements as well as low test scores. Unfortunately, test scores remained a key to training and assignment. Thus, the majority of these new sailors could not qualify for technical training and were relegated to the least desirable jobs in the Navy.

Within a year after the end of the draft, the proportion of black enlisted men in the Navy increased from 5.5 percent to 8.1 percent. In that year, 1974, blacks made up 11 percent of first-term volunteers, marking the first time

that the proportion of black recruits matched the level of black representation in the general population [REF. 6].

Despite this progress, inequities for blacks could still be found in promotions, occupational selection and the administration of justice [REF. 6]. Equal opportunity and affirmative action programs were inaugurated throughout the early 1970s to address these problems.

The history of minorities in the Navy centers mainly on the experiences of blacks. Hispanics were not identified as a separate ethnic group for reporting purposes until 1976.³ Shortly afterward, Asian-Americans, American Indians, Alaskan Natives, and Pacific Islanders were differentiated as individual racial/ethnic groups and separated from the traditional "Other" category.

³ Prior to 1976, "Hispanics" were identified on the basis of their surname. In 1976, the method of determining Hispanic status was changed to self-identification (Defense Equal Opportunity Management Institute, 1989).

II. NAVY AFFIRMATIVE ACTION PLAN

A. DESCRIPTION

The foundation of the Navy's equal opportunity program, on the personal level, is indoctrination and training of all personnel regarding equal opportunity issues. On the institutional level, equal opportunity is putting into action policies and programs that provide appropriate opportunities to all employees for upward and lateral mobility, thus enhancing quality of life. The flagship of these programs is the Navy Affirmative Action Plan (NAAP).

The NAAP identifies specific categories in which the Navy will take positive, affirmative steps to achieve a demographically balanced composition of personnel, ensuring fair treatment and freedom from discrimination. Among the categories to be monitored are accessions, assignments, promotions, discipline, and utilization of skills (occupational placement).

The NAAP is designed as a continuing program of goals and actions with realistic milestones. The impact of NAAP is assessed on an annual basis, and milestones are revised and updated by comparing statistical trends within each category, as well as through verbal feedback from cognizant commands.

[REF. 1]

According to the Navy's own studies, there is ample evidence of a skewed distribution of minorities along the spectrum of occupational specialties [REF. 3]. Specifically, minorities tend to be underrepresented in the more technical ratings. That finding, in and of itself, would not necessarily justify an affirmative action program. The Navy's definition of affirmative action is "the taking of positive steps to correct or eliminate present or future institutional discrimination that decreases equal opportunity due to race, color, national origin, religion, or gender, and all traces of past discriminatory policies or practice." [REF. 1] To merit consideration for affirmative action, the unequal occupational distribution of minorities must somehow be shown to be the result of institutional bias.

To be sure, as discussed in Chapter I, the history of the Navy is replete with personnel policies and practices that have discriminated against racial/ethnic minorities, particularly blacks. It is debatable whether remnants of these policies and practices still exist. However, since occupational placement of minorities is listed as one of twelve major points in the NAAP, one must assume that the Navy believes some remnant of these practices still survive in one form or another.

The primary tool for both the screening of potential enlistees and the assignment of individuals to military occupations is the Armed Services Vocational Aptitude Battery

(ASVAB) [REF. 4]. Performance on the ASVAB is the basis for determining whether a new recruit is qualified for the Navy's career fields and training programs. Based on an applicant's score and his or her personal preferences, the individual is assigned a date to commence a training program, if any, with designation as an occupational specialist in a field upon completion of the program.

B. APPLICATION

The Job-Oriented Basic Skills (JOBS) program is a potentially powerful weapon of the Navy Equal Opportunity Office to combat disproportionate minority representation. JOBS is an intensive course of basic and remedial instruction. It is provided to a select group of new recruits who show promise but lack the formal education to score high enough on the ASVAB to qualify for the more technical training programs ("A" schools). The dependence on JOBS as a key element in an ethnic/occupation balancing strategy stems from acknowledgment that a large number of minorities need help to attain qualifying scores for entry into the more technical "A" schools.

Figure 1 below shows the percentage of new recruits, by racial/ethnic group, who score above or below the 50th percentile on the Armed Forces Qualification Test (AFQT). The AFQT is a composite of verbal and quantitative subtests from

the ASVAB. It is not used directly in the job assignment process. [REF. 7]

As seen in Figure 1, there has been a marked increase in the proportion of Hispanic recruits scoring above the 50th percentile on the AFQT from 1984 to 1989. In that same period, the proportion of white and black recruits with scores above or below the 50th percentile remained virtually unchanged.

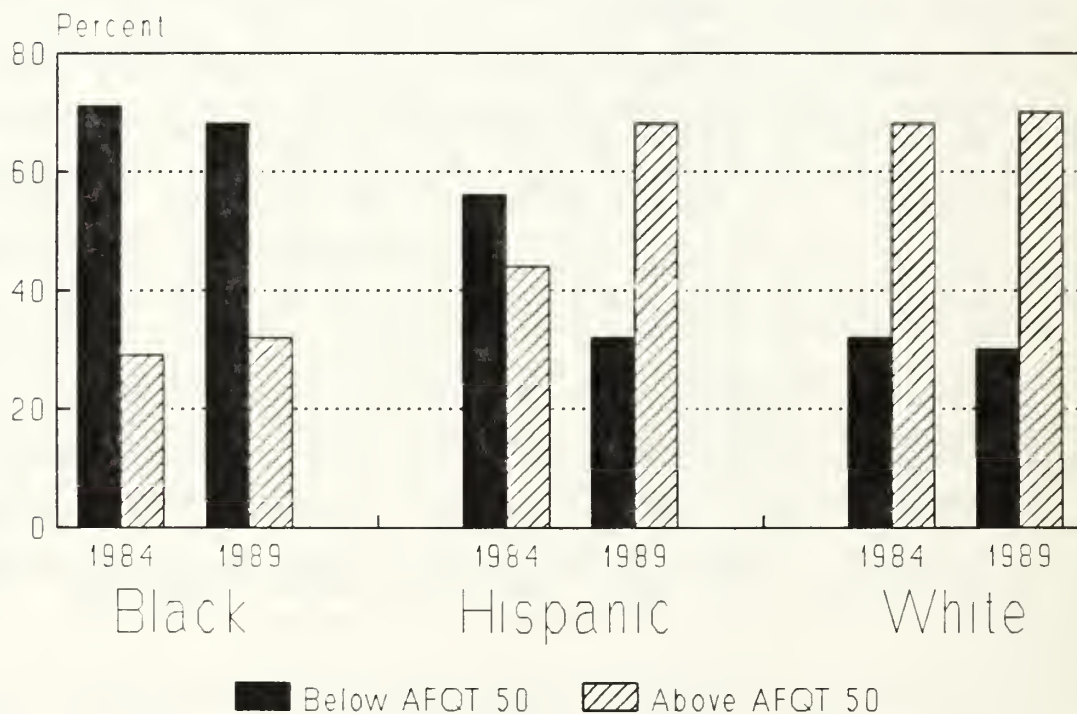


FIGURE 1

New Recruits Who Scored Above and Below AFQT 50
By Racial/Ethnic Group, FY 1984 and FY 1989

If the minority aptitude deficiencies depicted above can be overcome in sufficient numbers through the JOBS program alone, then proportional attendance at the "A" schools should eventually be achieved. Consequently, occupational specialties would eventually become racially balanced.

The Navy classification and assignment process was computerized in 1984 under a system named Personalized Recruiting for Immediate and Delayed Entry (PRIDE). PRIDE is a system used in assigning applicants to specific "A" schools for which they may qualify, matching an applicant's personal preference and qualifications. CLASP, (for Classification and Assignment within Pride) is a computerized model or algorithm that matches available training programs with applicant information and generates a list of programs which the applicant is offered. In 1988, PRIDE was found ineffective in distributing minorities among all ratings. The CLASP algorithm was subsequently adjusted to promote a more representative distribution of blacks and Hispanics. As yet, it is too soon to evaluate the results of the adjustment.

[REF. 4]

ASVAB scores are currently the primary determinant in the "A" school assignment process. As such, poor performance on the ASVAB (sometimes erroneously equated with a "lack of skills") prevents many minorities from attending the more desirable "A" schools. This circumstance no doubt accounts for at least some disparity in ethnic representation within

Navy jobs. Exactly how much of the disparity can be attributed to "lack of skills" is not known.

III. METHODOLOGY

A. ZUCCA'S MODELS

Zucca proposes three models to analyze the representation of minorities in Navy occupational specialties [REF. 5]. These three models are the Cohort model, the Self-interest model and the Core Technology model. He developed these models to explain the occupational distribution of ethnic groups in a complex organization (i.e., the U.S. Navy) after implementation of an affirmative action policy. Of the three models, Zucca seemed to be most satisfied with the results of what he terms the Core Technology model. This model views an organization in terms of its core and peripheral technologies. As applied to the Navy, core technology specialties include, for example, those involving the operation of weapons and propulsion systems aboard ships and aircraft. Peripheral specialties are those involved with support and administration. Yeomen, Mess Specialists, and Corpsmen are examples.

Zucca's other two models attempted to account for additional possible factors in the placement process. One looked at the cohort effect, that is, how an aberration in the cohort of entry-level recruits tends to perpetuate over time up the rank structure. The other studied the notion that

persons in power positions tend to protect and nurture along members of their own ethnic identity. Zucca conceded the two models were plagued with methodological problems, and he was somewhat dissatisfied with the results of both.

Under the widely held notion that organizations desire to protect their core technology from outside influence [REF. 8], this model suggests that occupational specialties which represent the core technologies of the Navy are traditionally white (and "male" as well) and that personnel in power positions within the organization tend to maintain them as such. Hence, Zucca's "Core Technology Hypothesis": All factors being equal, minority groups will be overrepresented in peripheral occupational specialties and, conversely, underrepresented in core technology specialties.

The Core Technology model appears to be the most valid of Zucca's three models. This model is replicated here and described more fully below in Chapter IV. The most recent data available to Zucca at the time of his research were from the year 1982. The present study analyzes the data for the year 1990, currently the most recent available. In addition, 1986 data are used to provide a bridge of continuity from Zucca to the present and to examine trends, fluctuations, or cyclical patterns.

B. COHORT EFFECT

Any study such as this must consider the influence of a cohort effect. Specifically, if there were an underrepresentation of a particular minority among a cohort of qualified entrants into a certain occupational specialty in the past, this same underrepresentation, or "crimp," should remain with the cohort as it progresses through the years of service and up the rank structure.

Since the Navy only accepts recruits at the entry level, it would take a considerable amount of time (perhaps ten or twenty years) after the implementation of an effective affirmative action plan for the results to manifest themselves. Consequently, there is a considerable delay between plan conception and accomplishment of specified goals of the program throughout the entire paygrade strata.

Executive Order 11246 of 1972 required the military services (and all government agencies) to implement an affirmative action plan. Even if the plan were fully effective, there would have been only ten years of progress before Zucca did his study. Thus, he was hampered to some degree by the cohort effect. He recognized this and developed a separate model to account for this influence.

Coming eight years after Zucca, this study expects a lesser influence of the cohort effect. There should have been sufficient time since the implementation of an affirmative action program for anticipated changes to have occurred. Of

course, perfect implementation cannot be presumed to take place, as Zucca showed quite well in 1982. It is the extent of implementation since Zucca's research that is now the issue.

C. DATA SET LIMITATIONS

This study, like Zucca's, compares the distribution of black and Hispanic ethnic groups across occupational specialties and paygrades with that of their white counterparts. Zucca examined the distribution during the years 1976, 1979, and 1982. This study adds to that with results from the years 1986 and 1990.

Blacks and Hispanics were selected for study because they represent by far the largest of the minority groups in the United States. "Whites," as group, are used as a focal point for comparison for blacks and Hispanics. Together, these three racial/ethnic groups account for 93 percent of the male petty officer population, up from about 90 percent in Zucca's study [REF. 5].

This study is limited to men only who are Navy petty officers, or enlisted personnel in paygrades E-4 through E-9. The reasoning behind this restriction is that all petty officers have one and only one selected occupational specialty. Although some enlisted personnel in paygrades E-1 through E-3 also have designated specialties, most do not.

Additionally, the seven construction ratings (generally referred to as Sea Bees) are not included in the data since they operate rather autonomously, outside the Navy promotion and selection mainstream. Finally, the ratings of legalman, master-at-arms, and Navy career counselor were deleted because these ratings contain only paygrades E-6 through E-9 and their members are laterally transferred in from other Navy occupational specialties.

Zucca realized that core technology occupations generally require higher skill levels than do peripheral occupations. However, he was still faced with the problem of distinguishing between occupations that are involved with core technology and those exclusive to peripheral technology. In complex organizations the line delineating the two is often blurred at some point and difficult to distinguish. Each category contains some specialties that could be conceived as properly belonging, at least in part, to the other. Obviously, some subjective decisions were made on the part of Zucca in the categorization process. Regardless, for continuity purposes this study maintains the same subsets of occupations as did Zucca [REF. 5]. Of course, some ratings have been deleted and others added in the eight years since Zucca conducted his analysis; so, again, some judgments are necessary concerning the categorization of borderline ratings.

D. APTITUDE AS A FACTOR

To determine the degree to which aptitude influences distribution, one must first isolate this factor from all other possible factors. Since ASVAB scores are the only measure of aptitude used in the occupational placement process, these scores become the targeted variable. By developing a procedure for isolating the influence of aptitude, one can then control for it. Having accomplished this, one can essentially eliminate the "aptitude" variable from the job placement process. By measuring any residual imbalance of minority proportions, one can then estimate the original influence when differences in aptitude were present.

This is precisely what Zucca set out to accomplish with his "Core Technology" model [REF. 5]. The fact that Navy enlisted minorities are underrepresented in the more technical ratings is well documented in the literature on personnel issues [REF. 7]. To further assert that this overrepresentation is nearly as marked after accounting for the differences in aptitude, as Zucca has done, should call for a serious inquiry into the matter.

When Zucca's findings were published in the Summer 1986 edition of Armed Forces & Society, fellow researchers in the manpower field took note. By controlling for aptitude prior to determining rates of overrepresentation and underrepresentation of minorities in occupational fields, Zucca was essentially dismissing the Navy's explanation of

"lack of qualification" as justification for distributional discrepancies.

Revelations such as these warrant a double-check. By replicating Zucca's work, that is, running his Core Technology model using the most recent data (as well as intermediate data for continuity purposes), this study serves as that double-check.

IV. THE MODEL

A. THE USE OF ASVAB

The measured differences in aptitude scores from one ethnic group to the next has generally served to displace, or at least effectively mask, the presence of other factors that may contribute to disproportions in minority representation within Navy ratings. One must be able to control aptitude to ascertain the influence of factors other than aptitude involved in the placement process. To best do this, the variable should possess the proper attributes. Naturally, the variable must first be common to all members of the data set. In addition, it must be easily quantifiable and readily accessible. The ASVAB scores of new recruits fit all three criteria.

As previously mentioned, all recruits are required to take this vocational aptitude battery as part of the enlistment process. The results of the test are used to determine eligibility for enlistment as well as for occupational training. The ASVAB consists of ten separate subtests, reflecting a gamut of skills and technical knowledge [REF. 7]. These subtests are as follows:

<u>Subtest Title</u>	<u>Abbreviation</u>
General Science	(GS)
Arithmetic Reasoning	(AR)
Word Knowledge	(WK)
Paragraph Comprehension	(PC)
Numerical Operations	(NO)
Coding Speed	(CS)
Auto and Shop Information	(AS)
Mathematics Knowledge	(MK)
Mechanical Comprehension	(MC)
Electronics Information	(EI)

Various combinations of these subtests are used to form aptitude composites. These composites are chosen and applied based on their ability to predict training performance for broad classes of occupations within the Navy [REF. 7]. For example, "Basic Electricity/Electronics," an aptitude composite used to screen recruits for several specialties in this field, combines the subtests General Science (GS), Arithmetic Reasoning (AR), and Mathematics Knowledge (MK) (which is also given a double-weighting). Occupational specialties grouped within these broad classes require a minimum score to qualify for the training program (or "A" school) associated with that specialty. For example, the "A" school leading to designation as an Electrician's Mate may require a minimum score of 200 on the composite mentioned

above [GS + AR + (2xMK)]. To qualify for Air Traffic Controller school, a minimum score of 210 on the same composite may be required.⁴

B. APTITUDE GROUPS

A means for controlling for aptitude was introduced by Zucca in 1984. Zucca realized the need to find a common basis by which to compare the many diverse occupations of the Navy. There exists no direct method to judge the difference in aptitude levels required for each of the Navy's ratings. The aptitude composites used to screen recruits for each rating are generally unique and quite often contain no subtest in common with composites used for other ratings. For this reason, Zucca developed a method for standardizing each composite score. This methodology is described below.

To control for the aptitude variable (ASVAB scores), it is necessary to first rank each rating in descending order by the minimum score required for entrance into that rating's "A" school and then group the ratings based on the order of their ranking. Because most ratings use a unique combination of ASVAB subtests, ranking of minimum scores cannot be done directly. Each subtest is standardized to a mean of 50. An average standardized score for each rating may be obtained by

⁴ These minimum scores are called "cut scores" and are obtained by summing the standard scores for each subtest in the composite. The other services use a different procedure or scale in setting their composite cut scores.

dividing the composite minimum score by the number of subtests forming the composite. Based on this average score, all occupational specialties can be ranked and placed into one of three "aptitude" categories (low, medium, or high), with roughly one-third of enlisted petty officers falling into each slot. Table 2 provides the range of the computed average standardized scores and their breakdown into aptitude groups.

TABLE 2

Aptitude Groups (by Score Range) Used in the Study

<u>Aptitude Group</u>	<u>Score Range*</u>
Low	45.0 - 49.0
Medium	49.1 - 51.6
High	51.7 - 55.0

* Scores were calculated by dividing the composite minimum score for each rating's "A" school by the number of subtests forming the composite.

Looking at the medium aptitude group above, the scores making up this category fall into a relatively small range on either side of the mean (50). The small variance associated with this "bunching" effect precipitated rather inconsistent and confusing results. Consequently, findings emanating from

the medium aptitude group are discounted to a large extent. Nonetheless, the occupational ratings falling on either extreme of the aptitude spectrum--the high and low aptitude groups--have the greatest potential for overrepresentation or underrepresentation of minorities. These extremes are of greatest interest to this study, the model is only slightly degraded by the limitations of the medium aptitude group.

Based on the ASVAB scores of new recruits depicted in Figure 1 in Chapter II, one would expect to find a smaller percentage of both blacks and Hispanics than of whites in the high aptitude group. Similarly, one expects a larger percentage of both minorities, as compared to whites, in the low aptitude group. Table 3 below shows the racial/ethnic composition, in percent, of each of the aptitude groups.

TABLE 3

Percentage Distribution of Male, Navy Petty Officers in
Aptitude Groups, By Racial/Ethnic Group, FY 1982 and FY 1990

<u>Aptitude Group</u>	<u>1982</u>				<u>1990</u>			
	<u>White</u>	<u>Black</u>	<u>Hisp</u>	<u>Total</u>	<u>White</u>	<u>Black</u>	<u>Hisp</u>	<u>Total</u>
High	88	9	3	100	83	12	5	100
Medium	87	10	3	100	80	15	5	100
Low	82	14	4	100	76	18	6	100

All Petty Officers	85	12	3	100	80	15	5	100

Source: Defense Manpower Data Center.

As shown in Table 3, the percentage of whites decreased within every aptitude level from 1982 to 1990. Correspondingly, the percentage of blacks and Hispanics in every aptitude group increased over the eight-year period. (This is consistent with the percentage decrease in whites and the percentage increase in blacks and Hispanics in the petty officer population as a whole, as depicted in Table 6 in Chapter V.) Table 3 above also reveals another expected pattern. The higher the aptitude defining each group, the greater the representation of whites relative to both blacks and Hispanics. The degree by which this disparity is present

lessens somewhat in 1990, but the same pattern persists. Since both of these trends are consistent with demonstrated parameters of the petty officer population at large, a measure of validity can be attributed to the ASVAB normalizing procedure mentioned above.

C. DIFFERENCE INDICATORS

The statistic used to summarize and describe the distribution of blacks and Hispanics in the petty officer population, the Difference Indicator, was first introduced for military use by Nordlie et al. (1975). This method assumes that all ethnic groups are randomly distributed throughout the population. For instance, if Hispanics constituted 7 percent of the Navy's petty officer population, under this assumption, one would also expect Hispanics to account for 7 percent of each occupational specialty. Any difference between the minority composition of the particular rating and the petty officer population as a whole is calculated in the Difference Indicator.

The formula for calculating the Difference Indicator (DI), as used by Nordlie et al. (1975) and later by Zucca (1984), is as follows:

$$DI = [(Actual\ Number / Expected\ Number) \times 100] - 100$$

Where:

Actual Number = The number of members of a particular ethnic group in the category of interest.

Expected Number = The number of members of the ethnic group of interest one would expect to find if members of that group were randomly distributed throughout the population.

The Expected Number is derived by multiplying the percent of the minority group in the aptitude group by the total population in that category. For example, from Table 3 above, we know that for fiscal 1990, among the group of ratings requiring the highest aptitude, 12 percent of that group is black. Therefore, the Expected Number (of blacks) of any subset of that group would be the total number of members of that group times 12 percent.

The Expected Number is divided into the actual number to form a ratio. This ratio is then multiplied by 100 so it can be expressed as a percent. Finally, 100 is subtracted from the result so that, when the actual and expected numbers are equal, the DI equals zero, rather than 100. This means that any "overrepresentation" of the minority group appears as a positive number and any "underrepresentation" appears as a negative number. Continuing with the example, suppose the subset of interest from the highest aptitude group contains 1,000 members. Of those, 100 are black. The Expected Number

(of blacks) would be 120 (from 1000 x 12 percent). Solving for the Difference Indicator (DI):

$$\begin{aligned} DI &= [(100 / 120) \times 100] - 100 \\ &= - 16.6 \end{aligned}$$

The negative sign here denotes underrepresentation. The 16.6 indicates that, for this particular subset of ratings, at this particular aptitude level, blacks are 16.6 percent underrepresented.

The selection of the base line population (from which the Expected Number is calculated) is crucial to the determination of the DI. This is where Zucca deviates from Nordlie and others [REF. 5]. Nordlie et al. (1975) used the entire enlisted population of the Army as the basis for computing the expected percentage of each ethnic group. This assumes that minorities are distributed evenly without regard to their individual qualifications. This was far too broad for Zucca, as his emphasis was on controlling for the qualification variable. In Zucca's model the expected percentage used as a base only those enlisted personnel with the level of qualification required for the particular set of specialties being evaluated.

The Navy Equal Opportunity Office, in its annual assessment of equal opportunity and affirmative action programs already in place, uses the same equation for

calculating DIs as does Nordlie et al. and Zucca. However, the Navy's version, called the Minority Representation Index (MRI), like that of Nordlie et al., incorporates the entire enlisted community as a base for relating expected percentages of minorities. As previously discussed, this approach assumes that all ethnic groups are proportionately identical across the qualification spectrum for all specialties, aptitude requirements notwithstanding.

If this assumption were true, then the Expected Number would be the same, regardless of method of derivation. If this assumption were not true, which is more likely to be the case, then the Nordlie and the Navy versions introduce a margin of error into the calculated indices.

D. OCCUPATIONAL CATEGORIES

Occupations were categorized according to the job description for each occupational specialty. Every Navy rating was assigned to either Core, Core Support, or Support technology based on the following criteria [REF. 5]:

OCCUPATIONAL CATEGORIES

- (1.) CORE TECHNOLOGY: Ratings involved in the operation of propulsion, detection, or weapons systems aboard ships and aircraft.
(Example: Sonar Technician)
- (2.) CORE-SUPPORT TECHNOLOGY: Ratings whose primary job functions are to maintain and repair equipment directly associated with the operation of ships and aircraft.
(Example: Aviation Structural Mechanic)
- (3.) SUPPORT TECHNOLOGY: Ratings that provide logistic, medical, and administrative support to the operating forces.
(Example: Disbursing Clerk)

Table 4 below shows the number of ratings, and the number of petty officers in these ratings, by both occupational category and the three aptitude levels.

TABLE 4

Number of Navy Ratings and Petty Officers
By Occupational Category and Aptitude (Apt) Group, 1990

	<u>CORE</u>		<u>CORE-SUPPORT</u>		<u>SUPPORT</u>		<u>TOTAL</u>	
<u>Apt Group</u>	<u># of Rtgs</u>	<u># of Pty Off</u>	<u># of Rtgs</u>	<u># of Pty Off</u>	<u># of Rtgs</u>	<u># of Pty Off</u>	<u># of Rtgs</u>	<u># of Pty Off</u>
High	14	43,345	13	36,111	13	28,135	40	107,591
Med	9	25,277	5	29,977	6	6,675	20	61,929
Low	<u>11</u>	<u>65,694</u>	<u>5</u>	<u>16,225</u>	<u>7</u>	<u>27,825</u>	<u>23</u>	<u>109,744</u>
Total	34	134,316	23	82,313	26	62,635	83	279,264

Source: Defense Manpower Data Center.

The Difference Indicators, or DIs, were calculated for each of the paygrade tiers, E-4 through E-6 and E-7 through E-9, within each qualification category for the years 1986 and 1990. If the model hypothesis is correct, that is, if the organization seeks to "shield" its core technology from outside influence (i.e., minorities), one would expect to see DIs for the core technology category to be greater (i.e., more positive indices) than the DIs in the core support and support categories. Further, since level of qualification has been controlled by the categorization of ratings with nearly equal aptitude levels, the model suggests that the DIs within any one category of ratings should be roughly equivalent.

V. RESULTS

A. NAVY ENLISTED DEMOGRAPHICS

Navy enlisted population demographics, shown in Table 5 below, have generally continued the same trends evident in the last two decades. Specifically, the proportion of both blacks and Hispanics has steadily increased and the proportion of whites has steadily decreased. The proportion of all ethnic groups composing the "Other"⁵ category has stayed relatively constant. It can be seen in Table 5 that the proportions of both blacks and Hispanics have increased even as the size of the enlisted force has grown. Recall, from Figure 1, that even though recruitment of blacks has been on the rise, the average scores on the ASVAB of these new recruits have shown little or no increase over time. On the other hand, the scores of Hispanic recruits have increased markedly over the past few years.

⁵ "Other", in this case, refers to members of the ethnic groups "American Indian/Alaskan Native" and "Asian American/Pacific Islander" and persons self-classified as "Other/Unknown".

TABLE 5

Percentage Distribution of Total Navy Enlisted Force
By Racial/Ethnic Group, FY 1982 and FY 1990

<u>Fiscal</u> <u>Year</u>	<u>White</u>	<u>Black</u>	<u>Hispanic</u>	<u>Other</u>	<u>Total</u> <u>Percent</u>	<u>Number</u>
<u>1982</u>	78.4	12.4	3.2	6.0	100.0	481,679
<u>1990</u>	70.7	17.7	6.1	5.5	100.0	501,542

Source: Defense Manpower Data Center.

B. DATA SET DEMOGRAPHICS

The pattern of change in the Navy enlisted force, as shown in Table 5, is carried over into the Navy's petty officer corps (paygrades E-4 through E-9). It is this enlisted corps that is of most concern here, since petty officers constitute the vast majority of enlisted personnel with designated occupational specialties (or ratings). Table 6 shows the changes that have occurred in the racial/ethnic representation of petty officers between 1982 and 1990.

TABLE 6

Percentage Distribution of Navy Petty Officers
By Racial/Ethnic Group, FY 1982 and FY 1990

<u>Fiscal Year</u>	<u>White</u>	<u>Black</u>	<u>Hispanic</u>	<u>Other</u>	<u>Total Percent</u>	<u>Number</u>
<u>1982</u>	80.3	9.8	2.7	7.2	100.0	300,247
<u>1990</u>	73.9	14.9	4.8	6.4	100.0	312,804

Source: Defense Manpower Data Center.

This study attempts to determine what portion of the disparities in minority representation within the Navy's occupational ratings can be directly attributed to differences in the aptitude levels of new recruits. This can be done by controlling for the "aptitude level variable," and removing it from the occupational placement "equation." Once done, any remaining disparities in minority representation can be quantified and measured. These remaining disparities must then be attributed to factors other than aptitude differentials.

This procedure necessitates removing as many variables from the placement equation as possible. By restricting the data set to petty officers, every member in the set will have one and only one occupational designation. Further, by excluding women from consideration, legal and policy

constraints relating to female occupational placement are avoided. Finally, this study is limited to blacks and Hispanics, the two largest racial/ethnic groups in the U.S. and the two groups that are traditionally included in assessments of institutional discrimination. The data set thus consists of male petty officers who are in the white, black, and Hispanic racial/ethnic groups only.

Table 7 shows the change in the make-up of this data set over a fourteen-year period. The table expresses changes in the ethnic groups as they relate to each other only, since all other ethnic groups have been omitted.

TABLE 7

Percentage Distribution of Male Petty Officers
By Racial/Ethnic Group, Selected Fiscal Years, 1976-1990

<u>Fiscal Year</u>	<u>White</u>	<u>Black</u>	<u>Hispanic</u>	<u>Total*</u>
<u>1976</u>	91	7	2	100
<u>1982</u>	86	11	3	100
<u>1986</u>	84	12	4	100
<u>1990</u>	80	15	5	100

*Note: The base population excludes persons in racial/ethnic groups other than those shown here. This tends to raise the proportions depicted here relative to other proportions that are for the population as a whole. Other racial/ethnic minorities represented between 5 and 7 percent of the male petty officers over this period.

Source: Defense Manpower Data Center.

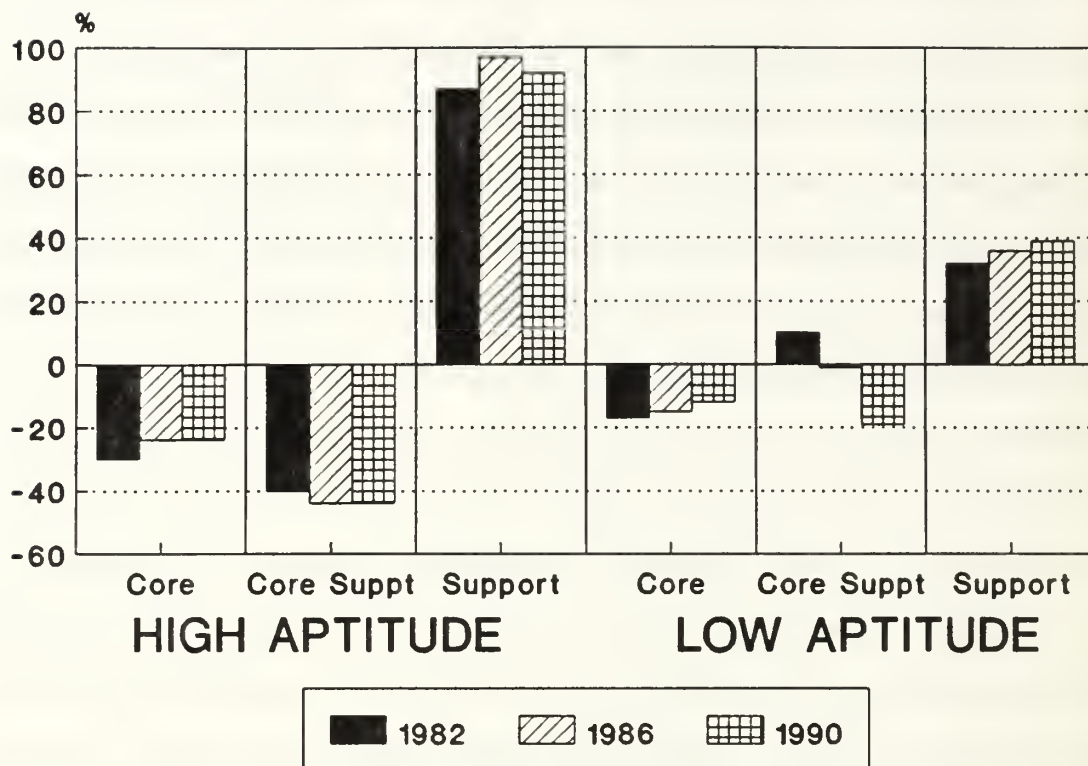
As expected, and very much like the distribution of the total petty officer population depicted in Table 6, the percentage of whites steadily decreases with a corresponding increase in the percentages of both blacks and Hispanics. One would expect, based on the information in Table 7 alone, that the rise in minority petty officers would be reflected in a proportional rise in the representation of all Navy ratings.

Given the information regarding recruit ASVAB performance in Figure 1, showing the overall lower scores for blacks as compared to Hispanics, and to a greater degree whites, one would then expect a rise in the black composition of Navy ratings requiring lower ASVAB scores. Based on the same information, one would expect to find increased representation of Hispanics in the ratings requiring higher ASVAB scores and the decreased representation of this group in ratings requiring lower scores.

C. RESULTS FOR BLACKS

To compare actual representation with "expected," the Difference Indicators (DIs) have been graphed. Figure 2 presents the graph of all male, black petty officers in the high and low aptitude groups. (The medium aptitude group has been omitted due to the very small variance associated with the narrow range, resulting in inconsistent DI values.) The

horizontal axis denotes the three occupational categories into which all Navy ratings have been allocated. The vertical axis shows the percent of overrepresentation (positive values) and underrepresentation (negative values) by blacks in each occupational category for both high and low aptitude groups. The bars from left to right show the DIs for the years 1982, 1986, and 1990, respectively.



Note: Expected Percentage, High Aptitude Group, 1990 = 12.2.
 Expected Percentage, Low Aptitude Group, 1990 = 17.9.

FIGURE 2

**Black Representation Indices of Occupational Categories
 By Aptitude Group, Selected Fiscal Years, 1982-1990**

By placing under a single aptitude group only those occupational categories whose member ratings require that particular level of aptitude, the effects of differences in aptitude have effectively been controlled. For example, as stated in the note to Figure 2 above, blacks constitute 12.2 percent of the membership of all ratings that require the

highest level of demonstrated aptitude (as measured by ASVAB scores). Consequently, all else being equal, blacks should theoretically constitute 12.2 percent of personnel assigned to ratings requiring that level of aptitude.

The degree to which each occupational category differs from the expected percentage (in the example, 12.2 percent) is indicated by the graph of the Difference Indicators in Figure 2. Continuing the example, blacks in Core occupations during 1990 are shown to be 25 percent underrepresented. This means that the ratings making up the Core category--ratings involved with weapons, detection, and propulsion systems (e.g., Sonar Tech and Operations Specialist)--have 25 percent fewer blacks than the cohort of all ratings belonging to that aptitude group as a whole.

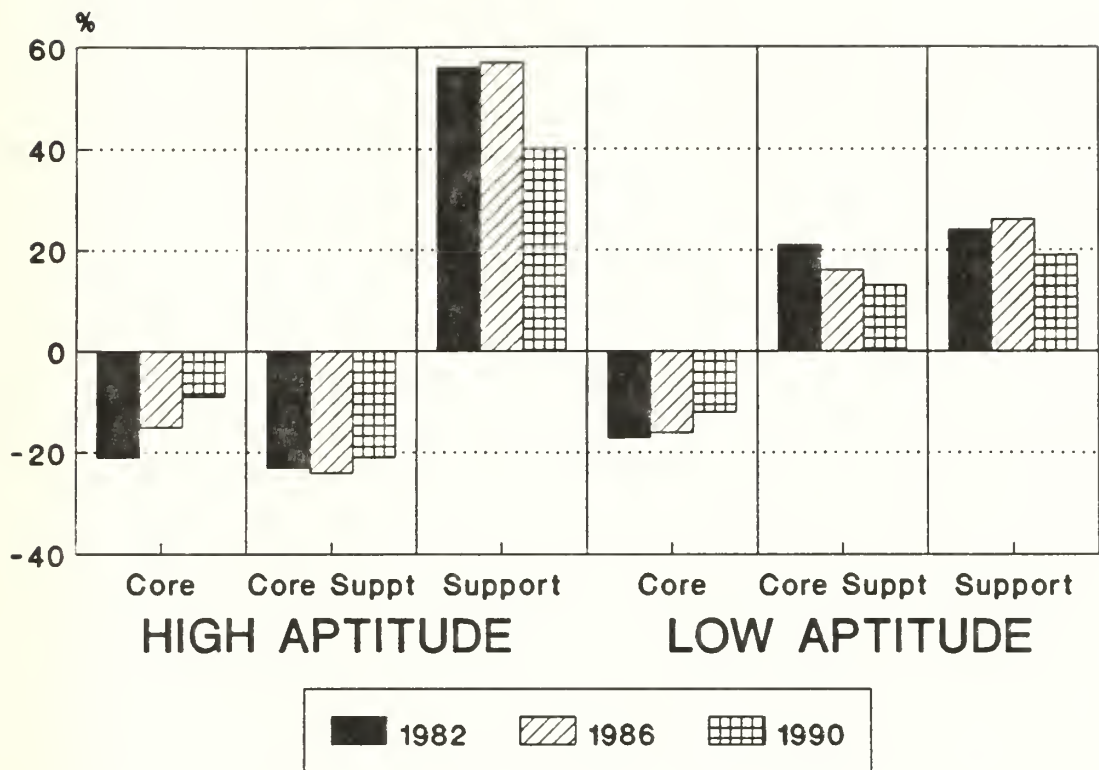
Similarly, in the Support category of the high aptitude group--consisting of ratings in the administrative, medical, and logistic fields (e.g., Yeoman and Storekeeper)--blacks in 1990 are 92 percent overrepresented. This translates to an average composition of 23.4 percent $[(12.2 \times .92) + 12.2]$ of blacks for the ratings in that category at that aptitude level.

It is readily apparent from Figure 2 that, at both the high and low aptitude levels, blacks are underrepresented in the Core and Core Support categories. At the same time, blacks are heavily underrepresented in the Support categories.

Comparing the high aptitude group to the low aptitude group, one can see a similarity in pattern, but a measurable difference in degree. The amount of underrepresentation or overrepresentation in the low aptitude group is about half that of high aptitude group.

D. RESULTS FOR HISPANICS

The Difference Indicators for Hispanic representation, displayed in Figure 3, resemble the results for blacks to a remarkable extent. Again, in the highest aptitude group, the minority (Hispanics in this case), is underrepresented in both the Core and Core Support categories and vastly overrepresented in the Support category. Likewise, in the low aptitude group, the Core and Support categories mirror the negative representation directions of blacks, but the Core Support direction is positive.



Note: Expected Percentage, High Aptitude Group, 1990 = 4.6.
 Expected Percentage, Low Aptitude Group, 1990 = 5.6.

FIGURE 3

**Hispanic Representation Indices of Occupational Categories
 by Aptitude Group, Selected Fiscal Years, 1982-1990**

It is important to note in Figure 3 that the trend of the Difference Indicators from 1982 to 1990 has been heading toward the zero baseline. This is true for every occupational category, regardless of aptitude group. A zero index value

would indicate Hispanic representation consistent with the Expected Percentage in each aptitude group.

E. RESULTS BY PAYGRADE

Dividing the data set of Navy petty officers by paygrade assists in the further analysis of the results.

1. Paygrade Description

Dividing the petty officer data set into the six individual petty officer paygrades, E-4 through E-9, can help to reveal patterns of occupational choice over time. For instance, many people in the junior petty officer ranks (E-4 through E-6) in 1982 were in the senior petty officer ranks (E-7 through E-9) in 1990.

For purposes of simplicity in presenting the data, results for each paygrade will not be graphed. Rather, the same information is conveyed, in a more concise manner, by dividing the six paygrades into two groups. The natural point at which to make the division is between the paygrades E-6 and E-7. The Navy views members in paygrades E-4 through E-6 as front-line supervisors. Those in paygrades E-7 through E-9 are considered senior supervisors and managers. Further, once the level of E-7 is attained, a sailor is deemed to be a "careerist," or one who intends to stay in the service until at least the 20-year point.

Table 8 shows the ethnic composition of each of the two subsets of the data set. Again, the years 1982 and 1986

are added to 1990 to reveal any trends manifested by composition changes over time. The total number of members in each subset for the selected years is listed in the far right column to indicate the rate of growth of the subset as a whole.

TABLE 8

Percentage Distribution of Male, Navy Petty Officers
By Paygrade and Racial/Ethnic Group, Fiscal
Years 1982, 1986, and 1990

E-4 through E-6

<u>Fiscal Year</u>	<u>White</u>	<u>Black</u>	<u>Hispanic</u>	<u>Total*</u> <u>Percent</u>	<u>Number</u>
<u>1982</u>	84	13	3	100	210,336
<u>1986</u>	83	13	4	100	245,263
<u>1990</u>	79	16	5	100	249,097

E-7 through E-9

<u>Fiscal Year</u>	<u>White</u>	<u>Black</u>	<u>Hispanic</u>	<u>Total*</u> <u>Percent</u>	<u>Number</u>
<u>1982</u>	92	6	2	100	36,570
<u>1986</u>	92	6	2	100	41,280
<u>1990</u>	89	8	3	100	42,564

* Note: The base population excludes persons in racial/ethnic groups other than those shown here. This tends to raise the proportions depicted here relative to other proportions for the population as a whole.

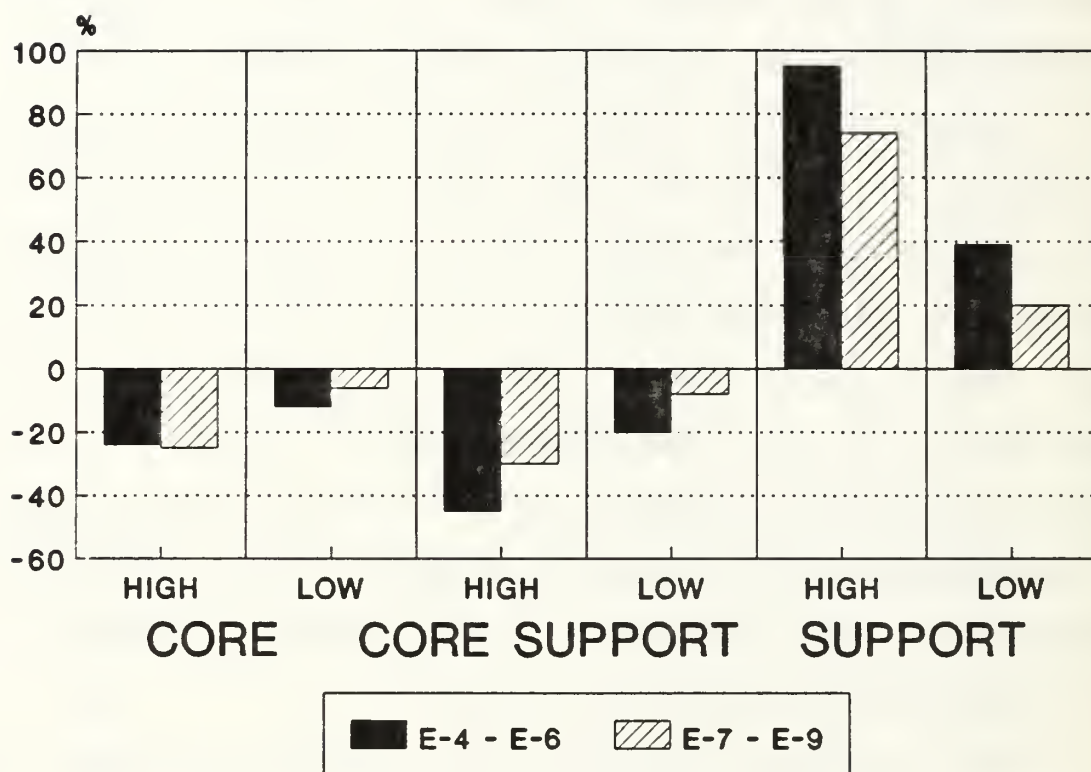
Source: Defense Manpower Data Center.

Two aspects of Table 8 are noteworthy for the purpose of this study. First, the percentages of black and Hispanic petty officers are much larger in the E-4 through E-6 subset than they are in the E-7 through E-9 subset. Consequently, the Expected Percentages used in calculating the DIs for each subset are proportionately larger for the junior petty officers than for their senior counterparts.

Second, from the totals in the column to the far right of Table 7, it can be seen that the rate of growth in the petty officer ranks has been faster in the four-year period from 1982 to 1986 than during the next four-year period to 1990. During the more rapid growth of the first period, the proportions of the three racial/ethnic groups remained virtually unchanged. However, between 1986 and 1990 there was a considerable increase in the proportions of black and Hispanic petty officers within the two paygrade groupings.

2. Results For Blacks By Paygrade

The Difference Indicators for blacks by paygrade in fiscal 1990 are shown in Figure 4 below.



Note: "High" and "Low" refer to aptitude groups.

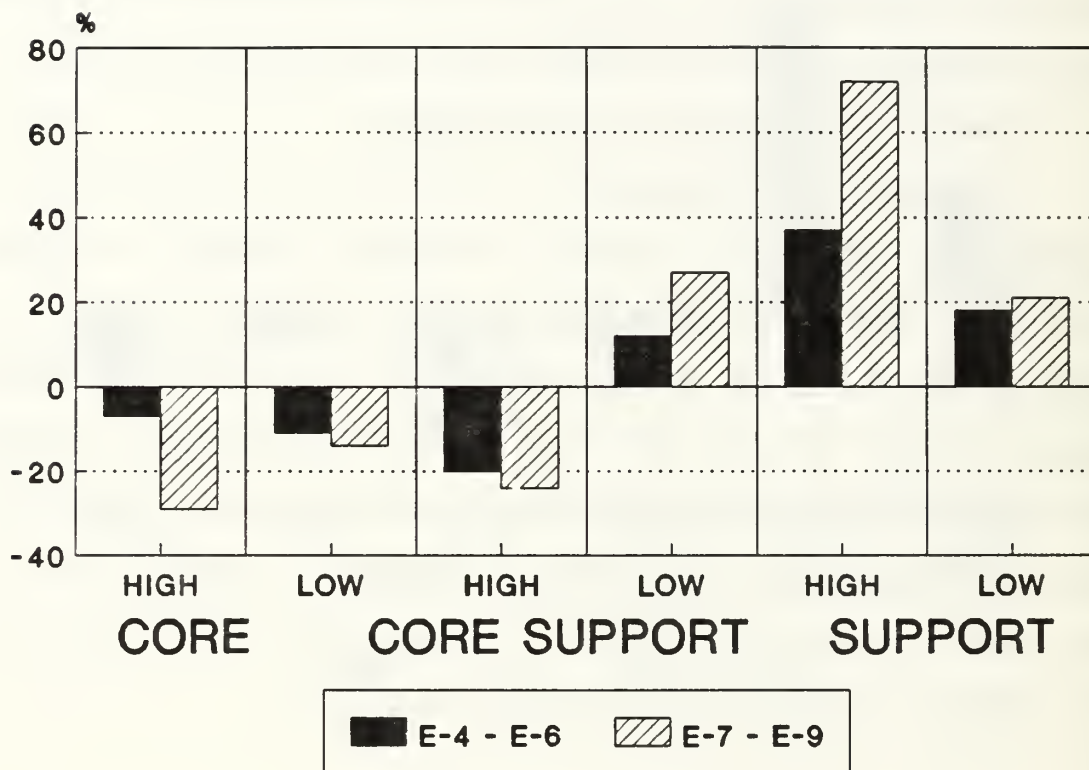
FIGURE 4

Black Representation Indices of Occupational Categories
By Aptitude Group and Paygrade, Fiscal 1990

The pattern of disproportionate black representation is the same for both paygrade subsets as it is for the black petty officer population as a whole. (See Figure 2) With the exception of the high aptitude Core category, however, the subset of E-7 through E-9 shows less disparity in levels of representation than does the E-4 through E-6 subset. In nearly all ratings, then, senior black petty officers are more proportionately distributed than their junior counterparts.

3. Results For Hispanics By Paygrade

The graph of Difference Indicators for Hispanics by paygrade, presented in Figure 5 below, stands in stark contrast to that of blacks. Like blacks, in every occupation category, the direction of representation is the same for both paygrade tiers. But, in the case of Hispanics, those in the senior paygrade grouping are farther from the zero index of "expected" representation (in some categories, much farther) than those in the junior grouping. This stands in contrast to the trend found for black petty officers.



Note: "High" and "Low" refer to aptitude groups.

FIGURE 5

**Hispanic Representation Indices of Occupational Categories
By Aptitude Group and Paygrade, Fiscal 1990**

VI. CONCLUSIONS

A. GENERAL

The primary purpose of this study is to estimate the influence of aptitude test scores on the distribution of blacks and Hispanics within the Navy's enlisted occupations or "ratings." It is well-documented that these minority groups tend to be underrepresented in the Navy's more technical ratings. On the other hand, these same groups tend to be overrepresented in the less technical support and administrative positions [REF. 3].

It is also well-documented that Hispanics and blacks have lower scores than whites, on average, on the tests designed to measure aptitude for occupational training assignments [REF. 4]. What is not well-documented is how much of the disparity in the representation of minorities can be attributed to their generally lower test scores. This study attempts to fill some of that void.

The promotion rates for personnel in different Navy occupations tend to vary somewhat, depending on the type of work being performed and its value to the organization. Advancement, for example, tends to be more rapid in the technical ratings than in the non-technical ones [REF. 4]. For this reason, the distributional disparity for minorities

falls in the highly visible realm of "equal opportunity," and so deserves a considerable degree of attention.

B. ANALYSIS

From Table 6 we can see that both blacks and Hispanics are assuming a steadily increasing percentage of the Navy's petty officer force. From Table 8 it can also be seen that this proportional growth has taken place in the senior petty officer ranks as well as in the ranks of junior petty officers, particularly over the last four years.

How this influx of minority petty officers is distributed throughout the Navy's occupational structure is of key importance. These new petty officers will set the tone, or at least provide a strong indication, of the effects of programs designed and implemented to remedy entrenched distribution imbalances.

If this cohort falls into the same occupational placement pattern as their racial/ethnic counterparts of earlier years, the distribution problem will not merely be perpetuated, but will actually be exacerbated. If, on the other hand, affirmative action recruiting policies and education programs have had their desired effect, an appreciable lessening in minority disproportions should be noticed.

It appears, from the results of this study, that blacks and Hispanics have followed quite different paths over the past eight years in the selection of their occupations. Black

representation in the various Navy ratings, already known to be skewed, has, at best, maintained the status quo. Indeed, it is quite likely that the degree of disproportionality has increased over the time period of this study. Hispanic representation, never quite as skewed as that of blacks, appears to be on a course toward parity.

1. Analysis of Black Representation

Referring to Figure 2, the story of black representation in the three occupational categories used in the Core Technology model can be readily discerned. In analyzing the data presented in the Figure, one must keep in mind the "Expected Percentage" differences between aptitude groups. Because black recruits achieve generally lower scores than whites on the ASVAB, one cannot realistically expect blacks to be proportionately represented in ratings that have the highest aptitude test score requirements.

When the aptitude variable is controlled, it is determined that blacks should constitute 12.2 percent of personnel in ratings requiring high aptitude, and 17.9 percent of the personnel in ratings requiring low aptitude. (From Table 3, blacks constitute 15 percent of the sample petty officer force.) Even allowing for this difference in expected representation, black participation in the high aptitude categories is radically disproportional. Blacks, for reasons not completely explained by differences in aptitude test

scores, have been entering the Navy's Support occupations in relatively greater numbers than their white counterparts. The opposite trend has occurred in the Navy's Core and Core Support areas.

In the low aptitude categories, the disproportionality of black petty officers is more moderate. (Indices of under 20 percent could probably be considered "acceptable.") Representation is nearly consistent with the 17.9 percent of blacks that scored at this aptitude level on the ASVAB. Even so, blacks are still considerably overrepresented in the Navy's Support category ratings. The pattern from Figure 2 is clear: the higher the level of aptitude required for the occupation, after acknowledging differences in expected percentages, the greater the respective degree of disparity in the representation of blacks.

When blacks are grouped by junior and senior paygrades, as shown in Figure 4, the degree of disparity from the zero index is greater for the juniors. This seems to imply that junior petty officers are following the example set by their senior counterparts and are entering occupations that are already overrepresented by blacks, but doing so at an even greater rate. (The possibility was investigated that blacks are more evenly distributed in the senior petty officer ranks due to higher retention at the careerist level than whites. However, it was found that there is only a slight difference

in reenlistment rates between white and black petty officers at the third and fourth enlistment points⁶ [REF. 3].)

Figure 2 clearly shows the trend of black representation in Navy ratings over the eight-year period studied. In that span, it is disturbing to note no appreciable change in most of the categories. The exception is in the Core Support category in the low aptitude group. Here, representation went from a positive 10 to a negative 20. The direction of change is noteworthy, but a 20 percent differential is still fairly minor. With respect to the distribution of black petty officers, affirmative action programs in the past eight years have apparently maintained the status quo, at best.

2. Analysis of Hispanic Representation

Hispanic trends in occupational representation, as depicted in Figure 3, appear to indicate a moderate degree of success for affirmative action programs. While disparities exist, they are not as pronounced as with blacks. In only one category is the difference index greater than plus or minus 20 percent. That category, Support in the high aptitude group,

⁶ Blacks reenlist at a higher rate than whites when only the pool of those eligible to reenlist is considered. However, blacks experience a lower eligibility rate than do whites. Consequently, when both eligibility and reenlistment rates are factored together, the actual difference in black and white proportions before and after enlistment points is quite small.

a traditional haven of minority overrepresentation, has declined by one-third from 1982 to 1990.

The eight-year period covered by Figure 3 indicates movement by Hispanics toward the zero index (an "optimum" reflecting a level of expected representation) in every category. This trend is also observed in Figure 5. The degree of Hispanic overrepresentation or underrepresentation, in every category, is less for petty officers in the E-4 through E-6 paygrades than for those in the paygrades of E-7 through E-9. Clearly, junior enlisted Hispanics coming into the petty officer ranks are entering previously underrepresented occupations in greater numbers as opposed to areas of traditional Hispanic overrepresentation.

C. THE INFLUENCE OF APTITUDE

While this study attempts to separate the effects of differences in aptitude levels from the occupational placement process in general, and from occupational representation of minorities in particular, clearly there exists a relationship between the two. The fact that new Hispanic recruits are scoring much higher on the ASVAB than Hispanic recruits of six or seven years ago, and that Hispanic representation in all occupational areas is much more proportional now, cannot be passed off as coincidental. Likewise, the fact that the aptitude test scores of blacks entering the Navy have remained relatively low can certainly be linked to the finding that

there are still wide disparities in the occupational representation of this group.

Nonetheless, it has been shown in this study that the disparity associated with minority representation cannot be attributed solely to differences in ASVAB test scores. A considerable degree of disproportionate representation in Navy ratings remained after an attempt was made to control for the possible influence of aptitude. How much of the aptitude variable has been controlled in this study is not completely clear. The controlling procedure applied here does not lend itself to absolute verification.

The procedure used to control for the aptitude variable, introduced by Zucca (1984), cannot be mathematically verified or even assigned a statistical degree of certainty. Some assumptions were made where solid data were not available. To be sure, comparing aptitude levels between such widely varying occupational fields as aircraft mechanic and cook is a daunting task. Indeed, few researchers have attempted such an endeavor. To venture forth into this frontier at all is to invite criticism. Any such forays are to be commended.

Nevertheless, some shortcomings of the procedure should be noted:

1. Even though all of the ASVAB subtests are standardized to an identical mean of 50, a direct comparison of various subtest composite averages may be faulty. If two composites to be compared had several subtests common to both, then a

certain amount of validity could be granted to the procedure. But comparing two composites with no subtests in common is walking on thin ice. As it happens, many composites do contain common subtests. All composites contain either the subtests "Mathematical Knowledge" or "Arithmetic Reasoning," and many contain both. Additionally, "Word Knowledge" appears in more than half of the composites.

2. Composite score minimums are generally validated against success in occupational training and help the Navy determine which recruits are "trainable" in a given program. However, these minimum scores are flexible, and they may be raised or lowered based on manpower requirements or space availability in the training pipeline. At the same time, there are limits on the range of score flexibility, at least on the low end; and, historically, the Navy has attempted to keep the minimum required scores constant over time. Enlistment standards are more likely to change. Occupational standards, in contrast, are viewed as an "anchor" for personnel quality or a way of maintaining continuity in training programs and job staffing.

3. Aptitude is assessed at the beginning of the training pipeline through scores on the ASVAB. Racial/ethnic occupational representation is measured at the completion of training and beyond. In relating the two, no provision is made for personnel attrition from training. If a racial/ethnic group fails to complete training in

disproportionately higher percentages than another group during this period then an additional margin of error is introduced.

Given these limitations, the procedure has nonetheless gained acceptance. It was published in Armed Forces & Society, the respected journal of the Inter-University Seminar on Armed Forces and Society, surviving the scrutiny of both academic peers and journal editors. Major criticisms of the procedure have not been unearthed by this author as yet.

D. THE INFLUENCE OF OTHER FACTORS

A considerable amount of work in this thesis was devoted to studying the influence of aptitude on the distribution of minorities within Navy ratings. Factors other than aptitude may also exercise an important influence on occupational placement outcomes. Though the identification of these factors is not the focus of this study, they should at least be recognized here.

Personal preference no doubt plays a major role in occupation selection by members of all racial/ethnic groups.

No attempt was made to measure or estimate the influence of this variable. It may well be that personal preference outweighs all other considerations when a recruit selects a career field. Meaningful research in this area would greatly contribute to the body of knowledge concerning minority

occupational placement and assist those charged with monitoring Navy affirmative action programs.

Personal bias, intentional or otherwise, may also be a determining factor. Though any respectable organization would like to think that all traces of ethnic discrimination have been eradicated from its midst, only the naive would believe it to be so. The Navy devotes sufficiently ample resources to ensure equal opportunity education and awareness for all Navy personnel. Nonetheless, there are several situations in which personal bias may affect the occupational distribution of minorities:

1. A well-intentioned recruiter may unknowingly press his stereotypes of minorities and jobs onto an eager, yet ill-informed, recruit candidate.

2. Likewise, the "classifier," or career counselor at the Military Examination and Processing Station (MEPS) also has an opportunity to inject personal bias. The classifier's duty is to match recruit preferences and qualifications with available training openings. No one plays a larger part in the distribution process than this person.

3. On the job, supervisors and managers evaluate personnel performance. Their evaluations greatly influence the retention and advancement of each of their subordinates, and unintended bias may again be present.

E. A FINAL NOTE ON THE METHODOLOGY USED HERE

Gary Zucca completed his study in 1984. The methodology developed by Zucca was replicated in this study. He used his Core Technology model with 1982 data. The same model was run using 1986 and 1990 data with the results reported here.

One startling conclusion that Zucca drew from his work was that "racial inequalities in representation with regard to occupational placement . . . are not explainable by differences in human capital [REF. 5]." This was a bold statement at the time, when the common notion was that disparities in minority occupational representation were the result of a "lack of skills." Nevertheless, Zucca maintained that the ethnic composition of Navy occupations, as Butler (1976) and Nordlie et al. (1975) had discovered earlier for the Army, cannot be fully attributed to differences in aptitude.

This study suggests that Zucca was probably right. There have been some incremental changes in the results due to the time differential, but the findings are surprisingly consistent with those of Zucca.

Naturally, any theoretical or methodological error in Zucca's Core Technology model would have been duplicated in this study as well. Zucca conceded that his model could be misspecified, and it is again acknowledged here. This study was begun with the understanding that Zucca's approach and findings could prove to be flawed. However, only relatively

minor defects could be found in what is otherwise a useful method for assessing minority representation in Navy ratings.

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